

APPENDIX 2. TECHNICAL DATA FOR VHF/UHF COMMUNICATIONS FREQUENCY ENGINEERING

9. COSITE INTERFERENCE CONSIDERATIONS. Cosite interference results from the interaction of transmitters and receivers in close proximity. Usually this means in the same building, or in adjacent buildings up to one mile away for 50 watt transmitters and 2,000 ϕ away for 10 watt transmitters, but in the case of high power FM and TV broadcast stations, it can mean several miles away. The appendix contains a discussion of interference involving commercial broadcast stations.

a. Adjacent sources. In FAA cosite installations, the standard is a minimum separation of 500 kHz for VHF and 1 MHz for UHF when there is an 8 ϕ minimum separation between transmit antennas and an 80 ϕ minimum separation between transmit and receive antennas.

b. Harmonics. These come from two general sources.

(1) FAA equipment. This is usually the second or third harmonic of VHF transmitters afflicting UHF receivers. It is generally quite difficult to operate a receiver on a direct harmonic of a transmitter cosite, even with transmitter band-pass filtering. Direct harmonic operation shall be avoided cosite.

(2) External sources. These can come from a variety of sources, FM and TV aural and video spurious emissions and harmonics in VHF and UHF, Land Mobile 35-50 MHz spurious emissions and harmonics in VHF, CB and Amateur in both VHF and UHF. The only ones that can be planned against are the FM and TV harmonics.

c. Spurious emission. Any frequency put out by a transmitter which is not the fundamental frequency is spurious. These are normally harmonics, which are easy to plan against, but also there are multiples and odd multiples of crystal oscillators or synthesizer mixers. Receivers also are subject to local oscillator radiation which can affect other receivers in the same rack or room. Principally, "image" interference to receivers, reception of a signal which mixes with the local oscillator to produce the receiver's IF, should be avoided. The FMO should be familiar with IF's used in receivers in a given site so that direct image reception can be avoided.

d. Intermod. This is the most common source of cosite interference. It results from the mixing of two or more cosite transmitters which, when added or subtracted from one another in some sequence, produces a resultant frequency equal to one being received elsewhere at the site. Discussion of intermod calculations will be found in paragraph 1405a(3)(d) of this order. FAA policy is to not assign frequencies having third order IM prediction from nearby possible sources..

e. Image interference. Interference can be generated by nearby strong signals which produce the IF by mixing with the LO in the receiver. This problem normally

occurs only with nearby and/or very strong signal sources. See paragraph 1405a(3)(e) for details.

10. LIMITS OF COVERAGE CHARTS.

a. A sufficient signal level is required at the aircraft anywhere within the FPSV as described in paragraph 3 of this appendix. A major factor in the coverage is the height of the antenna above effective ground and the roughness of the terrain surrounding the antenna location. Charts showing coverage at the two standard powers of 10 W and 50 W at different antenna heights are shown in figures 13-24.

b. The Brewster Angle is the term applied to the effect of lobing of the theoretical "doughnut" radiation pattern around a vertical antenna in space. In practice, most FAA RCF antennas are ground planes, and have a modified radiation pattern just from the plane effect. In addition, there are direct rays from the antenna to the aircraft and rays which are received as a result of reflection from the ground.

c. Lobing is caused by the difference in phase of the transmitted signal arriving at the receiving point as a combination of direct rays and reflected rays. Depending on frequency and antenna height above effective ground, these rays can combine to produce an out-of-phase condition resulting in a very low level of signal, or an in-phase condition where the signal level is enhanced. These conditions vary with altitude, distance, power, frequency and ground antenna height above effective ground.

d. The charts shown in figures 13-24 are intended to indicate the volumes of airspace within which a proposed FPSV or ESV will be provided with the required minimum signal of -87 dBm. All areas to the left of the respective curves are expected to have the minimum required signal level at any azimuth. However, there are definitely inaccuracies in some areas, particularly at the higher AGL antennas due to a discontinuity of signal levels at some altitudes at some distances.